

What is Claimed is

1. A piston pumping system comprising a piston guided within a guide tube and capable of performing a stroke movement along its longitudinal axis, opening into a
5 pumping chamber, the pumping chamber being connected via a liquid-conveying connection with valve to a storage vessel and from the pumping chamber a liquid conveying connection leads to a device for delivering the liquid, wherein the guide tube is formed an O-ring seal held by a groove which seals off the piston, has a gas permeation coefficient of 100 to 500 $\text{N}\cdot\text{cm}^3\cdot\text{mm}/(\text{m}^2\cdot\text{h}\cdot\text{bar})$ for nitrogen (N_2) and a radial
10 compression of less than 30% and the seal fills the groove with a groove filling level of more than 90%.
2. A piston pumping system according to claim 1, wherein the groove filling level is more than 95%.
- 15 3. A piston pumping system according to claim 1, wherein the valve is a non-return valve.
4. A piston pumping system according to claim 1, wherein a non-return valve is
20 formed in the connection to a device for delivering the liquid.
5. A piston pumping system according to claim 1, wherein the piston has a cross section of 0.25 to 4 mm.
- 25 6. A piston pumping system according to claim 1, wherein the piston has a length of 5 mm to 10 cm.
7. A piston pumping system according to claim 1, wherein the stroke movement of the piston along its longitudinal axis covers a length from up to 1 mm to 5 cm.

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8. A piston pumping system according to claim 1, wherein the O-ring seal consists of silicon.
9. A piston pumping system according to claim 1, wherein the piston is a hollow
5 piston in which the liquid-conveying connection with a valve which connects the pumping chamber to a storage vessel is integrated.
10. A piston pumping system according to claim 1, wherein the movement of the piston is mechanically controlled.
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11. A piston pumping system according to claim 10, wherein the piston is moved by means of a helical spring.
12. A piston pumping system according to claim 1, wherein the movement of the
15 piston is electronically controlled.
13. A piston pumping system according to claim 12, wherein the piston is controlled by means of a microchip.
- 20 14. A piston pumping system according to claim 12, wherein the piston is moved by means of a piezoelectric element.
15. A piston pumping system according to claim 1, wherein the pump volume is from 1 microlitre to 1 ml.
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16. A piston pumping system according to claim 1, wherein the device for delivering the liquid is at least one nozzle, at least one micro-pin or at least one microcutter along which the liquid is guided, at least canulas and/or at least one outlet.
- 30 17. A piston pumping system according to claim 1, wherein the cord thickness of the O-ring is from 0.3 to 3 mm.

18. A medical device for delivering pharmaceutical liquids comprising a piston
pumping system comprising a piston guided within a guide tube and capable of performing
a stroke movement along its longitudinal axis, opening into a pumping chamber, the
5 pumping chamber being connected via a liquid-conveying connection with valve to a
storage vessel and from the pumping chamber a liquid conveying connection leads to a
device for delivering the liquid, wherein the guide tube is formed an O-ring seal held by a
groove which seals off the piston, has a gas permeation coefficient of 100 to 500
 $\text{N}\cdot\text{cm}^3\cdot\text{mm}/(\text{m}^2\cdot\text{h}\cdot\text{bar})$ for nitrogen (N_2) and a radial compression of less than 30% and
10 the seal fills the groove with a groove filling level of more than 90%..
19. A medical device according to claim 18, wherein the medical device is a
transdermal therapeutic system which comprises in addition to the piston pumping system
a storage vessel consisting of at least one moveable element or having a venting opening
15 and at least one micro-pin or microcutter.
20. A medical device according to claim 18, wherein the medical device is an atomiser
for liquids, a nasal spray, an eye spray or an inhaler

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